

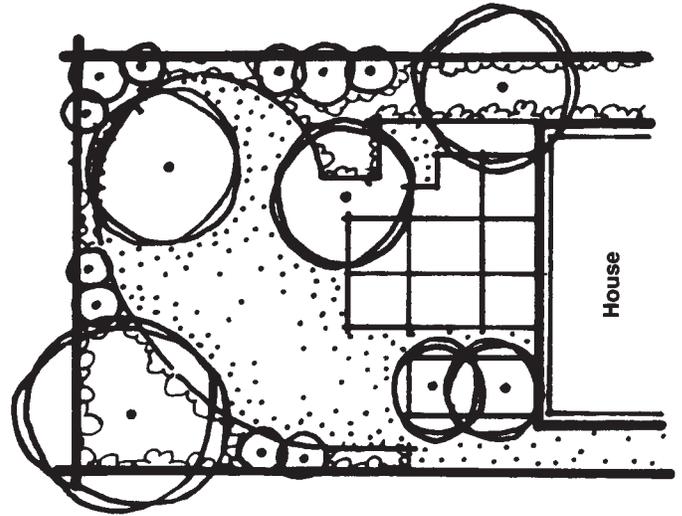
Landscape Design with Plants: Creating Outdoor Rooms

Janice A. Cervelli, former Professor, Landscape Architecture

The garden has been considered an essential element of a happy and full life since the beginning of time. As a result, landscape design has enjoyed equal stature with the major arts. The garden or landscape designer has held prominent positions in many cultures, including the courts of ancient Egypt, Renaissance Italy, Imperial France, China, and Japan. Master designers have generated many of the techniques of design through their own artistic talent, experience, and interpretation, as well as through strong sensitivity to the client, qualities of the site, and plants and materials used.

Today, landscape design is popular with the average homeowner. However, moving high-garden type art to the backyard context is difficult. When using plants in landscape design, the result is usually oversimplified and misinterpreted. Easy-to-follow “cookbook” landscape rules can be found in many popular landscape design magazines. Unfortunately, these publications do not discuss the overall three-dimensional structure of the design. Instead, they discuss the use of plants in terms of individual ornamental characteristics including form, color, and texture. In this type of approach to planting design, the most immediate visual attractions within the landscape are emphasized. One of the more important, basic, and classic aspects—the creation of three-dimensional outdoor space with plant walls, floors, and ceilings—is overlooked. That is unfortunate since this aspect of planting design can evoke the longest-lasting overall impression within the outdoor experience.

This publication outlines the often-overlooked concept of landscape design with plants as architectural, engineering, and aesthetic tools that build an enjoyable outdoor environment. It is not intended to present any textbook rules for home landscaping nor discuss the most appropriate use of specific plant species. Such techniques of design are developed through one’s own design experience or through viewing the design of others.



Plants as Architecture

Plants with respect to architecture can perform two roles. They can complement and reinforce the existing architecture of the house or structure, and they can create outdoor rooms.

Trees, shrubs, and ground covers can be used to emphasize the desirable architectural lines and masses of the house. The form and branching pattern of particular trees and shrubs can echo the vertical, horizontal, and diagonal roof and wall lines of a house. A pleasing, unified, and harmonious appearance can result (Figure 1).



Figure 1. Plants soften and filter light as well as blend with natural material.



Figure 2. Plant and house forms are in harmony.

Plants can be used to soften and balance harsh and awkward architectural angles, masses, and materials (Figure 2). Before actually purchasing and installing plants, an owner can plan the locations by assessing the desirable and undesirable qualities of the house. To do this, take a photograph of the front and back of your house, and sketch where plants are needed. Judge ultimate plant sizes at this time to ensure harmony with the house.

You can use plants to frame desirable views of your house. Remember, the best views are not always from straight on. Often, views to the entrance or windows are more interesting from an angle as one approaches from a drive or walkway (Figure 3). Selective framing allows the viewer to see only the best parts of the house and yard in a sequence that builds up curiosity.

Views of the house are important, but views from inside the house onto the front or backyard are even more so, and they merit consideration. A large shrub or medium-sized deciduous tree with lacy foliage and branching pattern can be used to provide enframement, a sense of scale, and an interesting foreground to the viewer from inside. In the winter, the branching pattern creates the same effect. Such a treatment can double your enjoyment of the landscape. Be careful to size and space the plant so that it does not overgrow and block windows.

The human eye has a tendency to follow the outline of the objects in the landscape. With this idea in mind, you can affect the apparent size of your house. By placing plants in increasing height away from the house corners, the horizontal lines are emphasized and its apparent length increases (Figure 4). This is especially helpful with boxy, two-story structures.



Figure 3. A grove of river birch is used to screen this house from the road. A sweeping drive, brought in from the left, focuses on the entrance of the house and discloses the rest of the house in a sequence.



Figure 4. By graduating plant sizes away from the house, the apparent size of boxy, two-story structures is increased.

The same arrangement in a scaled-down version can emphasize and lead the eye to the entrance or large picture window. Placing large, conical evergreen plantings on either side of the entrance often has the disastrous opposite effect of emphasizing the vertical lines, making the house appear taller and narrower and creating an uninviting, inhibiting appearance (Figure 5).

The proper placement of foundation plantings raises similar concerns. Evergreen foundation plants originally became popular for masking exposed foundation walls that were two to three feet thick and made of concrete block.

Most foundations on newer homes rarely expose more than 12 inches and can be masked with a ground cover. Older homes often have attractive stone foundations that should be emphasized, not masked. It is not always necessary to place great amounts of expensive evergreen plantings around the entire house.

It also is unnecessary to restrict the type of plant to evergreens such as yews or boxwood. Deciduous trees and shrubs are equally effective in complementing architecture. Deciduous plants can unify the architecture through a

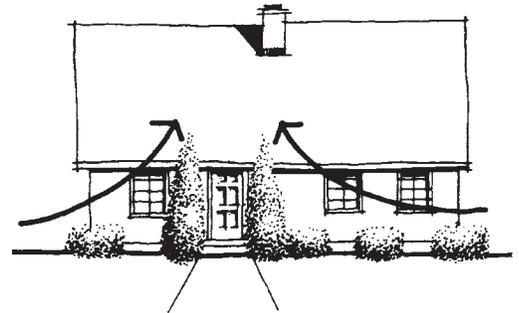
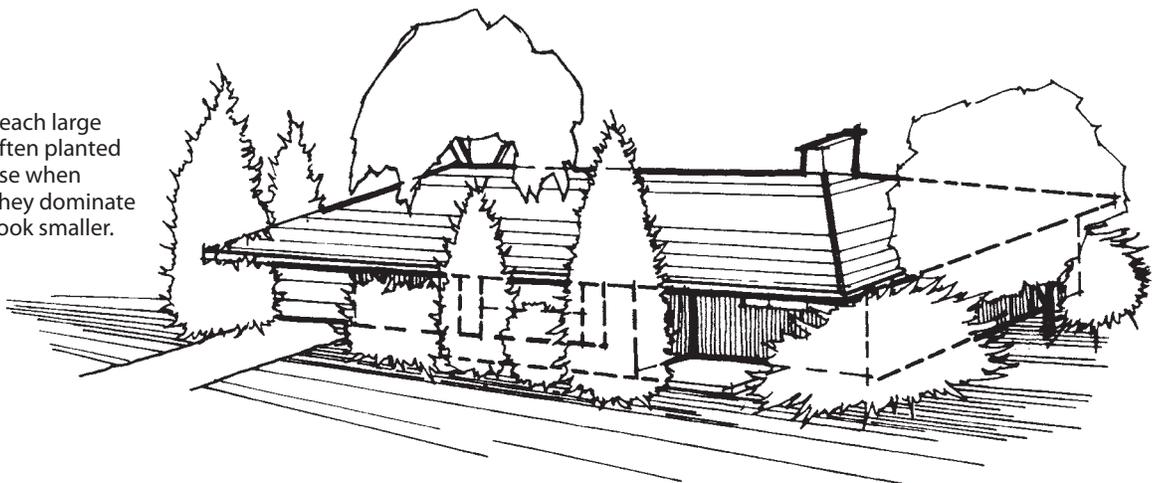


Figure 5. Tall evergreens create an uninviting, inhibiting appearance to this entrance.

branching pattern. For example, horizontal house lines can be unified with a horizontal branching pattern. Deciduous plants also add an infinite variety of color and textural interest throughout the year. All of this is possible without distracting from the main feature, the house.

The growth habits and requirements of plants must be considered when they are used close to the house. When sizing a plant, take into consideration its mature height and width. Otherwise, an overgrown and crowded appearance that dwarfs and hides the house can result (Figure 6). Consult a number of information sources concerning plant growth. Check any special cultural and maintenance requirements of the plants such as soil type, moisture, sun exposure, and pesticides.

Figure 6. Plants that reach large sizes at maturity are often planted too closely to the house when small. When mature, they dominate and make the house look smaller.



Creating Outdoor Rooms

The word architecture suggests the creation of spaces or rooms for use by people. Inside the home, floors, walls, and ceilings are used to create different settings for a variety of activities ranging from gardening, handiwork, and cooking to formal entertaining, relaxation, and active sports. As a result, greenhouses, garages, utility rooms, kitchens, living rooms, dens, studios, and gyms are created.

The development of outdoor architecture or outdoor rooms utilizes the same elements as indoor architecture—floors, walls, and ceilings. The difference is that the elements of outdoor rooms are composed of plant materials that have a changing and dynamic, living quality. As time passes, the room will grow and mature and provide a varying seasonal display each year.

The second role of plants with respect to architecture is the creation of outdoor rooms. Before creating such rooms, determine what number, type, and size of spaces are needed. List what type of outdoor activities you expect to conduct. The list might include entertaining, cooking, gardening, reading, painting, sunning, or relaxing. You might also want space for children's play, active sports, storage, building projects, hobbies, and maintenance. Those activities that require a separate room must be noted, as well as those compatible activities that can be combined in one space, such as a workspace, storage, and parking area. Note the desired qualities of the space; that is, sun or shade, or hard or soft surfacing.

The creation of the various outdoor spaces can take one of two approaches. The most typical involves the new homeowner in landscaping a house that had previously received some landscaping and where outdoor spaces such as patios already exist. The approach is similar to that of redecorating an older home: the basic floor plan remains the same while the qualities of the floors, walls, and ceilings are changed with the addition of a new rug, wallpaper, paint, and furniture.

In landscaping, the designer should assess the condition of existing plants and views and determine what is to stay and what needs improvement. The result may be a simple cleaning-out, trimming, replanting of existing plantings, or planting of new foundation plantings. This approach may appear to be the most efficient. However, it fails to completely consider the new owner's special needs.

The construction of most new homes is also completed with little consideration of outdoor rooms. The front and rear yards are left as two large spaces with the side yards as small voids (Figure 7). Foundation plantings around the house, hedges along the property lines, and a few shade trees are often added by the first owners, but these additions will do little to encourage the most efficient spatial development in each yard.



Figure 7. A small side yard developed into an intimate strolling garden.

The second approach to room creation is the development of new outdoor rooms. Compare this to changing the actual floor plan of an old house by knocking out walls or building an entirely new structure. To develop a new room, assess the qualities of the existing site. Such qualities as views, topography, drainage, sun and wind exposure, and proximity to the house can suggest appropriate locations for activities. This type of assessment requires you as the designer to experience the site and characteristics on a frequent basis through all of the seasons. This activity will allow you to get a “feel” for the site and better match its qualities to your needs.

The simplest approach to locating new rooms is to begin by extending the house's interior rooms to the exterior. The outdoor room will take on a function and quality similar to the indoor room, producing a stronger relationship and harmony between the house and the landscape as well as increasing the apparent size of both. In this regard, the location of the house on the property and the floor plan of the house can help with strategic window and door locations overlooking good views. The small patios and decks added to new homes by developers are a positive step in this direction. Similarly, the entrance foyer or vestibule can be extended outward by expanding and developing

the front porch and area. Garage and driveway access can be extended to include an outdoor work and storage space. Define these rooms with plant or constructed walls, floors, and ceilings to avoid blending them into one large, characterless space.

Further development of each individual outdoor room should begin by determining whether the space is inwardly or outwardly oriented (Figure 8). Inwardly oriented space is characterized by either complete or nearly complete enclosure and a strong central focal point. Certain areas for sitting, sculpture displays, patios, and hot tubs require enclosure for purposes of privacy, quiet, and concentration. Rooms within rear yards will typically contain such activities and require this type of orientation.

Outwardly oriented rooms are enhanced by amenities outside the space such as good views and breezes. Certain spaces may require selective cutting of existing plants to provide good views or the installment of new plants to

frame the views. In most situations, activities taking place within the front yard are more public in nature and will require free visual access on and off the site and little enclosure; thus, it is outwardly oriented.

Once you have determined the orientation and function of the outdoor room, you can define the basic elements of architecture: floors, walls, and ceilings. The floor of an outdoor room can provide for continuity and a comfortable transition throughout a number of spaces. The floor can be created with pavement, lawn, ground cover, annuals and perennials, or low (1' to 3') shrubs.

As in any building, the activity to take place in a room will determine the size and material of the floor. Just as work and exercise areas or kitchen areas have a durable linoleum, tile, or wood floor, similar outdoor areas in the yard should be underlain by a durable lawn or even hard pavement. Likewise, as a formal living room or entertainment area calls for a more decorative, plush carpet, so should a formal outdoor garden, patio, or terrace. A variety of swathes and ribbons of ground covers, annuals, and perennials provide the highly decorative effects of an oriental rug if carefully planned to take full advantage of seasonal interest.

The type of plant materials used to define the outdoor room also will suggest the function. Lawn areas typically invite low volume, pedestrian traffic, and relaxation, while spots with ground covers, annuals and perennials, and low shrubs do not. You can create an activity-oriented room using a lawn area bordered by ground cover or low planting beds. Or a passive viewing garden can be created with more elaborate planting combinations and little or no lawn (Figure 9).

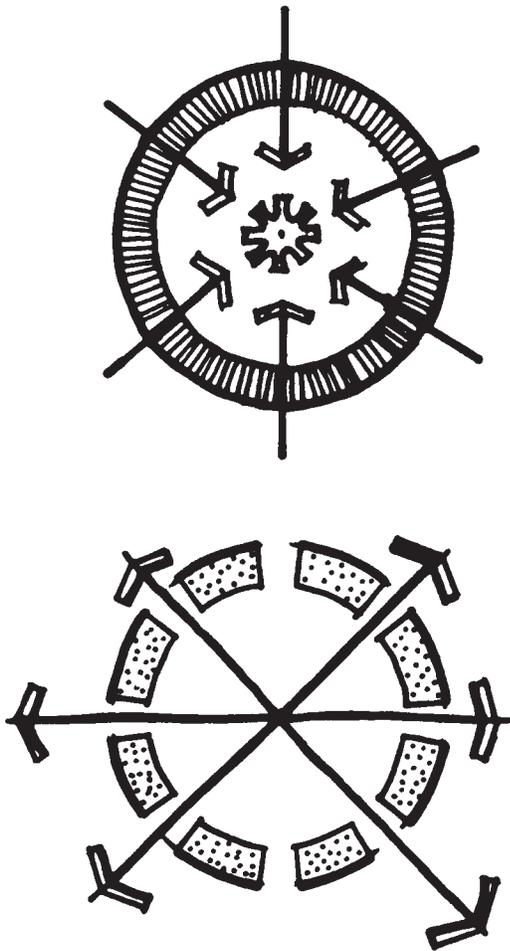


Figure 8 (top). Inwardly focused space.
Figure 8 (bottom). Outwardly focused space.

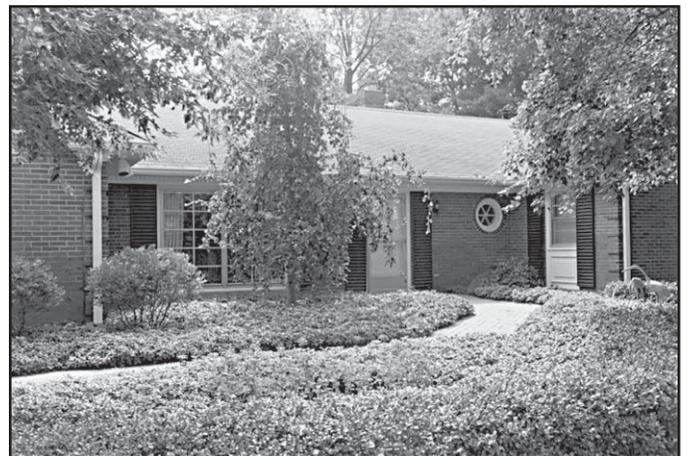


Figure 9. An outside extension of the entrance foyer creates a viewing courtyard of elaborate plant combinations instead of lawn.

In the same manner, suggest traffic volume and direction with the creation of pathways using lawn and planting beds. These pathways can act as a kind of breezeway to link two different outdoor rooms (Figure 10).

The extension of low planting beds to taller shrubs and tree masses and hedges can create very effective walls with which to enclose an outdoor room and direct traffic to it. Choosing the type of plant to use as a wall is similar to choosing a wallpaper for its texture, color, and ease of maintenance. The leaf, flower, and winter branching patterns of individual plants provide the same visual qualities as wallpaper. Height and thickness or density of the wall are determined by inward or outward orientation of the space and required degree of enclosure. Low to small shrubs (2' to 5') can be used to suggest partial enclosure but still allow views out of the space. Taller, dense evergreen shrubs (5' or taller) in combination with smaller shrubs and trees provide the strongest enclosure. Tall and medium trees (25' or taller) provide overhead enclosure but also allow views from underneath the canopy (Figure 11). Plants with more open growth habits can provide a partial screen to filter views.

Outdoor walks also can be used effectively to screen negative views, sounds, and smells near the space (Figure 12). The size and intensity of these negative elements will determine the size, spacing, and density of the screen. Poor views will generally require dense evergreen plantings or constructed screens for year-round effectiveness. Unpleasant smells require a combination of aromatic ground covers, annuals, perennials, shrubs, and trees to be placed downwind between the source and the property owner. Annoying sounds are especially difficult to screen with plants on small sites and require a combination of constructed walls, fences, and landforms.

Plant combinations can act as floors. Walls can frame the views in both inwardly and outwardly oriented space. Use low shrubs and ground covers as a foundation to offset a central focal point such as a sculpture piece or patio in an inwardly oriented space (Figure 13). Taller shrubs and trees enclose a space and lead the eye to a central focal point. Framing an outward view involves the same concept but uses trees, ground covers, or planting beds to draw the eye out of the space (Figure 14).

Outdoor ceilings are the most important part of the room, and you can create them with tall shrubs (10' or taller) and small, medium, and large trees (15' or taller). The orientation and scale or size of the room will determine the type of ceiling. Inwardly oriented space should have a wide variety of ceiling heights, density, and texture. Let desired intimacy or the scale determine the ceiling height.



Figure 10. Planting beds and walks act as a breezeway between driveway and entrance courtyard.



Figure 11. Various plant types, heights, and combinations create walls, partial screens, and overhead canopies.



Figure 12. A sculptured hedge creates a partial screen between parking area and entrance courtyard.



Figure 13. Low planting beds and overhead canopy enclose and complete this outdoor sitting area.



Figure 14. An overhead tree canopy helps to frame the outward view from this wood deck.

Rooms intending a grandiose effect such as a dining room or ballroom require high ceilings. Victorian homes with 10- to 12-foot high ceilings bring a distinctively different perceptual effect than the 8-foot high ceilings in more contemporary homes. With this in mind, you can create your style of outdoor room.

The density of the tree canopy and the overlap will determine the amount of light in the room. The darker the room, the heavier and smaller it may appear. It may also render a cooler, more mysterious effect on the viewer. A brighter room is generally perceived as lighter, airier, more comfortable, and larger to the viewer. Fine-textured plants such as honeylocust render a lighter, airier enclosure. Tall, dense evergreen shrubs and trees such as yews, pines, and firs render a darker wall and canopy enclosure. Careful

planning of the interplay between sun and shade at different times of the day can also bring about dramatic effects of light and dark.

The texture of the leaf and branching patterns across the sky in both summer and winter months also adds to the decoration of the room. The basic function, location, and orientation of the outdoor room can be further refined by determining the main motif or theme of the space.

The Composition of the Outdoor Room

We have looked at how plants can be used to enhance and frame a house or property and how to create outdoor space or rooms with plants as architectural elements. The next step is to give a pleasing form to the composition through the use of classic design principles such as unity, balance, and rhythm. These basic design principles are common to all art works. These qualities make artistic creations continually beautiful, interesting, and meaningful. Plants as well as man-made structures can be combined in an infinite variety to bring about balance, unity, and rhythm.

What is meant by balance, unity, and rhythm? In a balanced composition, the elements of design are distributed in some organized arrangement or order. Symmetrical and asymmetrical are the two basic types of balance. Symmetrical is the simplest form of balance (Figure 15). It is characterized by a set of similar images opposite a central axis or point. Asymmetrical balance is more irregular and displays an equal distribution and organization that is less obvious.

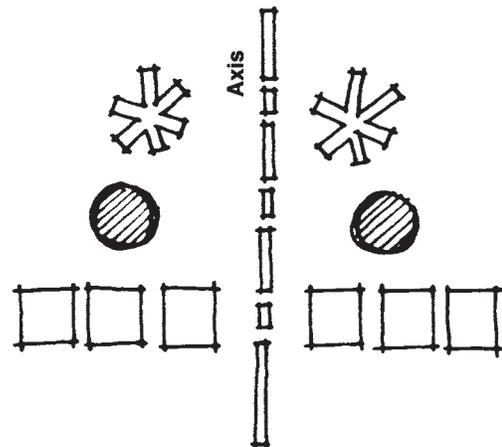


Figure 15. Symmetrical balance.

In a unified composition, the design elements are already in balance. Unified composition is most easily understood as having similarity of shape, size, or color of the various parts in the composition. Unity allows the viewer to read varied and diverse masses and spaces as one composition (Figure 16). For simplicity and to ensure a unified composition, the variety of plant genera and species in a design should be kept to a minimum.

The design concept of rhythm is similar to unity but serves the important function of creating variety and interest in the composition. Rhythm is generally achieved through repetition of a series of forms, colors, and textures in a particular order or pattern. This repetition will also include slight variations or a progression to serve as a treat for the eye or ear within a comfortable and continuous setting (Figure 17). Repetition of a pattern of plants, paving patterns, or landscape structures such as walls, fences, and steps provides unity, while an ordered variation in the pattern of size, shape, or spacing creates visual interest.

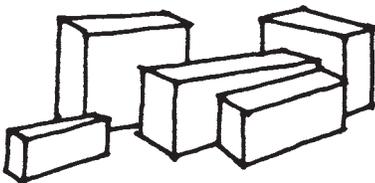


Figure 16. Unity through similarity of form.



Figure 17. Rhythm with progression.

Developing a Spatial Theme

Coordinate the development of unity, order, and rhythm within a space through the establishment of an overall theme or motif for the space. The theme should be appropriate to the function of the space as well as reflect the architecture of adjacent buildings. The four types of basic themes that can be given to a space are: (1) rectilinear; (2) angular; (3) curvilinear; and (4) a combination of the three.

A rectilinear theme is appropriate to traditional, classic styles typical of the Victorian period of architecture. The function of related outdoor spaces is typically formal entertaining and public and private viewing. The intended effect is one of orderliness, grandeur, and elegance. No one

element of the composition totally dominates, and all parts contribute to its overall organization. The pattern of landscape plants and structures is characterized by symmetry, well-defined edges, and a definite pattern of geometric shapes such as squares, rectangles, hexagons, or circles (Figure 18a and b).

A curvilinear or angular theme is more appropriate to the typical and somewhat smaller bungalow-type homes and more contemporary, stylistic structures. The function of the outdoor space in this situation is intended to include more casual entertaining, day-to-day living activities, hobbies, and recreation and leisure. The intended effect is one of comfort, relaxation, flexibility, and spontaneity. Due to frequent use, the informal space must provide variety and interest.



Figure 18a. The extension of this entrance foyer into the front yard creates an entrance courtyard.

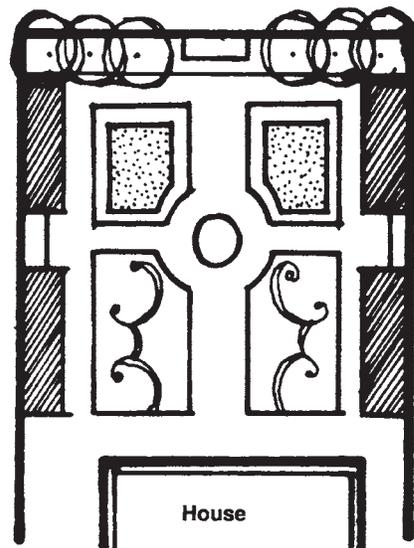


Figure 18b. A formal scheme with bilateral symmetry.

An angular theme is characterized by asymmetrical balance and strong rhythm to supply this interest (Figure 19). The angular theme is the contemporary and stylistic approach based on 45- or 60-degree angles. While forms and lines are still geometric and strongly defined, they assume more dynamic and movement-oriented qualities of the angle. Rhythm through repetition and progression is a very important ingredient that strengthens the quality of motion.



Figure 19. Landscape ties are used to create an angular scheme.

The curvilinear theme is very free in form (Figure 20). The intended effect is of even greater informality and flexibility. Balance and rhythm are not as apparent. Irregular but simple curves and less defined edges are dominant. Each element or a combination of elements demands the attention of the eye, rendering the overall organization of the space as less apparent and more subtle.



Figure 20. A brick walkway and edging strip create a curvilinear theme.

The fourth type of spatial theme is a combination of the rectilinear, angular, and curvilinear (Figure 21). Symmetrical organization with softened, more irregular forms produces a semiformal effect that suggests elegance as well as comfort. Approach this theme with caution since combining geometric, strongly defined shapes with free-form, irregular shapes is a tricky task. Forms in the immediate proximity to the building should take a more defined, rectilinear, or angular theme. As the space ventures farther away from the house, forms can be given a more curvilinear, naturalistic quality.

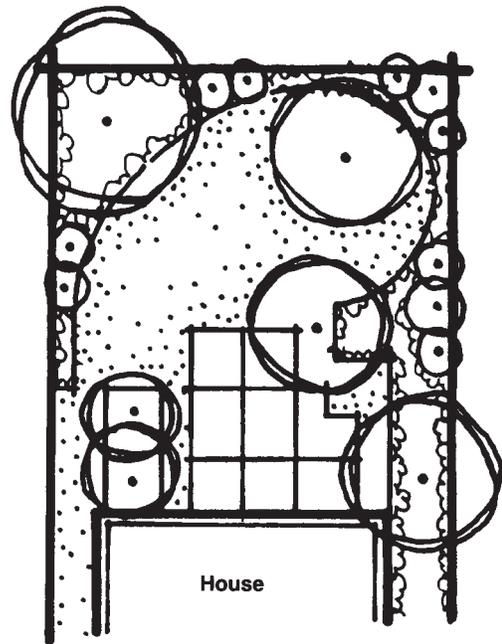


Figure 21. Semiformal scheme combines three themes.

Once the appropriate spatial theme is established, the task of creating unity, balance, and rhythm must be undertaken. Begin on the floor of the outdoor space and the patterns created by circulation on it (Figure 22a). Analyze where traffic patterns and activities will occur. You can then define this circulation pattern with various materials—brick, stone, concrete, gravel, or plants—to achieve a balanced pattern. You may want to give the circulation pattern more three-dimensional interest by traversing different levels. Wood decks or a series of terraces aid movement over sloping sites as well as add to three-dimensional interest. This pattern can be reinforced with walls and ceilings of the space (Figures 22b and 22c).

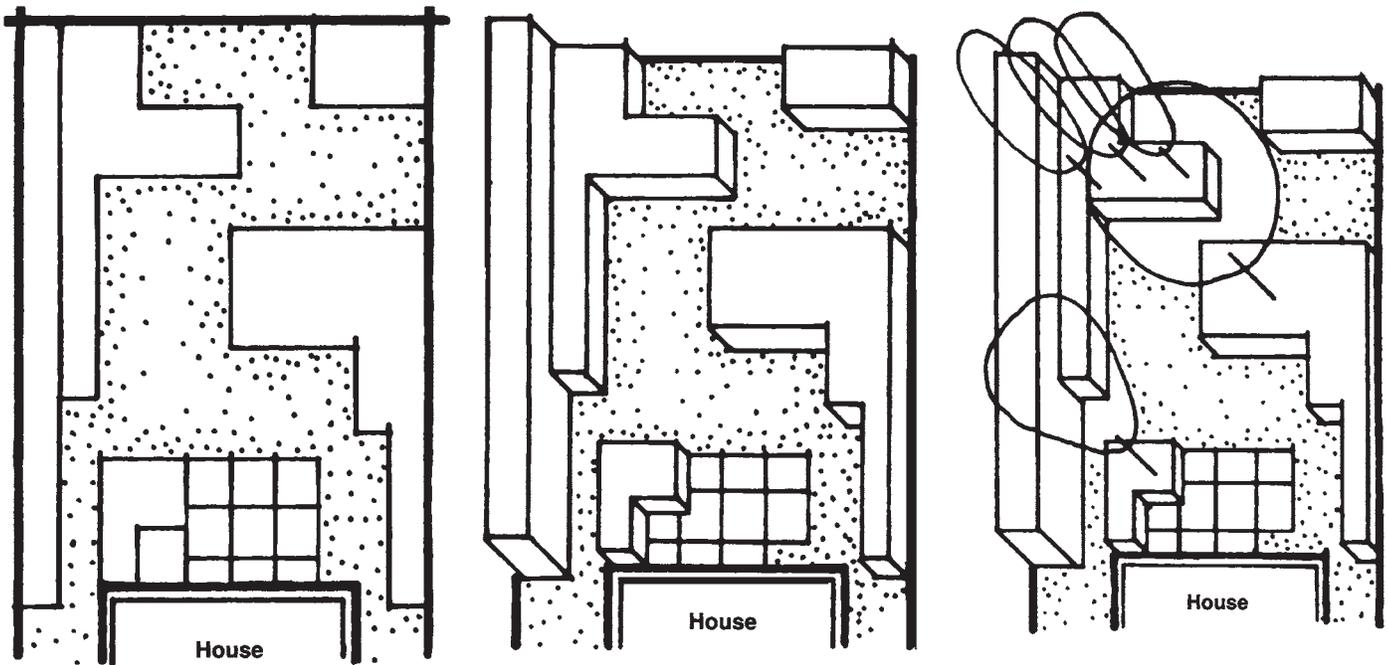
The shape of other landscape elements should conform closely to the floor pattern for a unifying effect. The walls and ceiling of the space can be created in several different ways using landscape plants or structures. Structural walls, retaining walls, steps, fences, earth berms, arbors, pergolas, and gazebos provide spatial enclosure.

The various materials you choose to create spatial floors and walls should also be appropriate to the overall spatial theme and the activity to take place in it. Concrete, brick or mortar, and stone in mortar are more characteristic of rectilinear and angular designs. These materials are

characterized by strongly defined edges and finishes and a quality of permanence. Wood, asphalt, brick in sand, sand, river stone, organic mulch, and landscape ties are more appropriate to informal designs. These materials are more comfortable to the touch and exhibit a less permanent quality.

Landscape plants also can be used to reinforce the spatial theme. As noted earlier, our goal is spatial development: the overall effect of the space, not the development of only one or two particular parts. The use of plants to create walls and floors deals more with the massing of a limited number of different plant species. This is in contrast to the random placement of numerous and unusual plant species, which will lead to a loss of unity and focus.

Lawn is a good example of a flooring material suitable to a formal setting. The degree of manicure of the lawn determines its degree of formality. Ground covers such as English ivy or myrtle as well as annual flowers are suitable to formal and informal settings. The shape of the planting bed and how clearly it is edged also determines the degree of formality. Lawn, ground covers, and perennials can also be used effectively in informal settings when included in curvilinear beds or those without an effective edging material.



Figures 22 a, b, c. Sequence of spatial development from floor pattern to walls to ceiling.

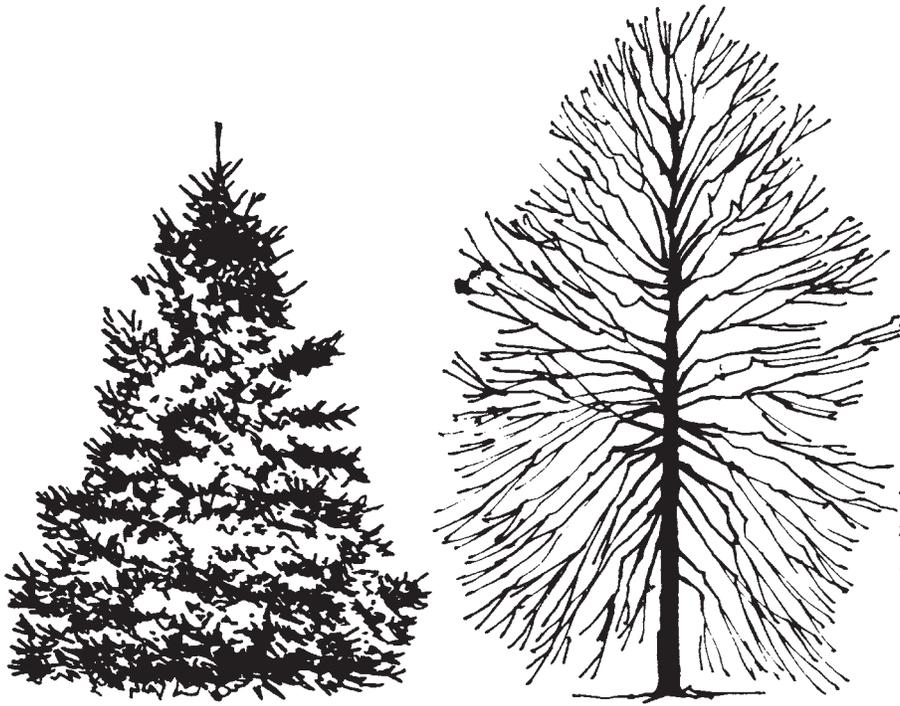


Figure 23. Evergreen and deciduous trees with regular, symmetrical forms.



Figure 24. Tree with informal, irregular form.

The form and branching pattern of trees and shrubs will determine their appropriate role in a spatial theme. Plants with regular, symmetrical, full forms in summer and winter are most effective in reinforcing the geometric patterns of a formal theme (Figure 23). Evergreen plantings are highly favored in this regard, lending to the popularity of yews and boxwood for a year-round effect. Unfortunately, many highly desirable deciduous plants with symmetrical winter branching patterns are overlooked by designers. A few trees and shrubs with symmetrical growth patterns suitable to formalistic settings include the following:

Trees

- Linden, little leaf
- American holly
- Hornbeam
- Sugar maple (mature species)
- European beech
- Flowering pear
- Flowering crabapple
- Pin oak
- Spruce
- Sweet gum

Shrubs

- Boxwood
- Yew
- Japanese holly
- Barberry
- Euonymus species
- Privet
- Dwarf ninebark

Several shrubs in their natural state have irregular growth patterns but are “forced” into geometrical shapes. Junipers, arborvitae, spirea, and forsythia are often improperly trimmed into boxes and spheres with disastrous results including sparse, woody growth. Care must be taken when choosing plants to ensure their tolerance for such frequent pruning.

Informal trees and shrubs have less defined shapes, irregular branching, and rounded forms (Figure 24). A few plants that fall into this category include the following:

Trees

- Birch
- Honeylocust
- Redbud
- Pine
- Yellowwood
- Amelanchier

Shrubs

- Junipers
- Dogwood
- Forsythia
- Spirea
- Rhododendron
- Lilac
- Hamamelis
- Oak leaf hydrangea

The role of plants in creating outdoor architecture should not be underestimated. You can use ground covers, shrubs, and trees to create floors, ceilings, and walls of outdoor rooms; to add unity, balance, and rhythm to a spatial composition; and to frame and enhance existing architecture.

The Engineering Role of Plants

In the past, attitudes toward plants and their function in the landscape were generally subjective and restricted to “romantic, gardenesque” applications. Because of the aesthetic qualities of plants, many of today’s landowners understandably still hold this attitude.

However, plants can serve other important functions that are not as obvious to the average property owner. Just as the engineering profession is primarily concerned with modifying our environment to make it safer, healthier, and more comfortable, landscape designers use plants to achieve these same objectives through erosion and pollution control and glare reduction.

The continual development of the land brings certain undesirable side effects. One of these is soil erosion, which is the wearing away of the topsoil layers through the forces of water and wind. Damage from impact and runoff of water can take the form of small troughs, then larger gullies, and end with more massive slips.

Plants can be placed on steep, exposed slopes to prevent the formation of troughs and gullies. Leaves and branches lessen the impact of raindrops and slow water runoff while shallow, fibrous root systems hold soil in place. The organic matter added to soil by plants acts as a sponge to soak up and retain water. In addition, plants add to the aesthetic appearance of the slope in comparison to constructed erosion-preventative materials.

Plants with shallow, fibrous root systems are the most effective controllers of erosion. Evergreen plants are more effective for year-round control. Some of the more effective plants include turf grasses.

Turf Grasses

Crown vetch (*Coronilla varia*)

Bugleweed (*Ajuga reptans*)

Periwinkle (*Vinca minor*)

Japanese spurge (*Pachysandra terminalis*)

Lily-of-the-valley (*Convallaria majallis*)

English ivy (*Hedera helix*)

Cranberry cotoneaster (*Cotoneaster apiculata*)

Lily-turf (*Liriope muscari*)

Horizontal juniper species (*Juniperus horizontalis*)

Staghorn sumac/Smooth sumac (*Rhus typhinal*)

Rhus glabra)

Pollution Control

Another role plants sometimes serve is the control of pollution in congested urban areas. Plants can purify the air by removing carbon dioxide and limited quantities of sulfur dioxide and replacing them with oxygen (1). The fresh air produced by plants along freeways or in heavily traveled streets mixes with and dilutes heavily particulated air.

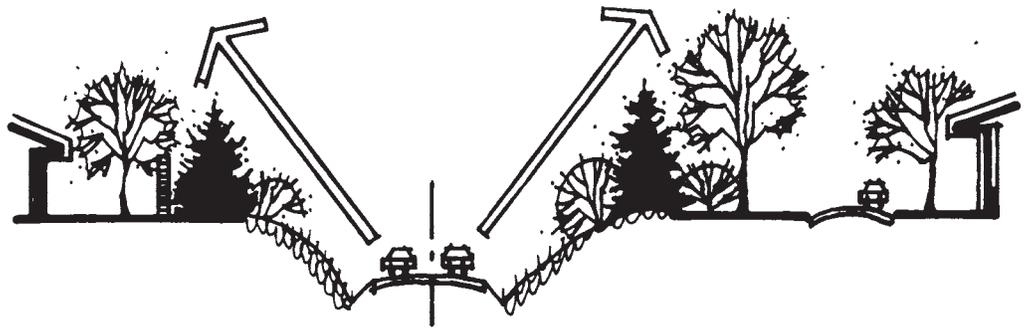
Plants can also cleanse the atmosphere by removing dust, ash, and smoke particles from the air. The particles settle on the leaves and branches and are eventually washed by rain to the ground. Studies have shown that roadways planted with trees contain one-quarter of the total number of dust particles per liter than those without trees in the same area of the city (2).

Plants can also, to a certain extent, be used to control sound pollution in urban areas and along freeways. However, adequate research has not been conducted that clearly demonstrates the total effectiveness of plants in this capacity. Effective sound control depends on the interaction of several factors including: 1) direction, frequency, and intensity of noise; 2) topography, wind direction and speed, temperature, and humidity of the local area; and 3) location, spacing, species, and density of the plant screen. In many instances, these interrelationships are complex and unpredictable. For example, a wind gradient caused by a planting mass can actually cause sound movement toward, rather than away from, a listener.

Plants have been shown to be most effective at screening the higher, more annoying frequencies of unwanted sound (3). Deciduous plants with thick, fleshy leaves and thin petioles have been shown to be most effective in absorbing, deflecting, and reflecting noise. Evergreen trees, shrubs, and ground covers can be mixed with deciduous plants to create a solid, year-round buffer. Wide bands of such massings, not often practical on medium- to small-sized lots, are required for reducing sound. Even then, total control cannot be guaranteed. Studies have found that plants reduce noise by seven decibels per 100-foot wide plantings. This is seemingly negligible when one considers that a general traffic and play area generates 90 decibels (4).

The most effective sound control can be achieved by combining plants with embankments and berms along with structural elements such as walls (Figure 25). A 6-foot high masonry wall covered with ivy combined with a 5-foot high evergreen hedge is both a practical and effective solution for most small-scale situations. The requirements for control of air and sound pollution by landscape plants support the case for more green spaces and belts in and surrounding urban areas.

Figure 25. Embankments, deciduous and evergreen plantings, and masonry walls are used together for effective sound control.



In addition to experiencing pollution problems, today's cities are full of bright lights and reflective surfaces that cause glare. The cause of glare can be either a direct light source such as the sun, bright signs, auto headlights, or a reflection from surfaces such as metal, glass, light-colored concrete walls, streets, walks, and water surfaces.

To filter or completely block glare, plants can be placed in key locations between the light source and the viewer. Care must be taken to choose a plant with appropriate size, shape, and density of foliage. In the case of a direct light source, the plant should be placed as close to the viewer as possible (Figure 26). In the case of reflected glare, the plant may be placed either between the light source and reflected surface or between the surface and the viewer. In either case, the location of the plant should be based on the season of year, time of day, and the angle at which the source strikes the surface. For example, the higher the angle at which the source strikes, the higher the angle of reflection and vice versa (Figure 27).

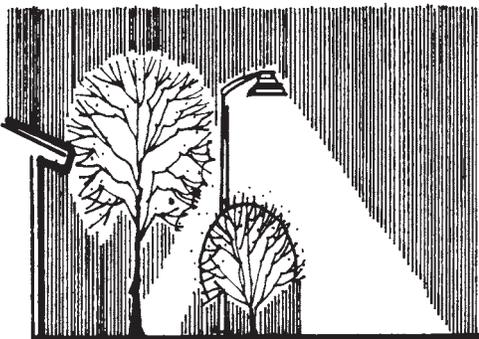
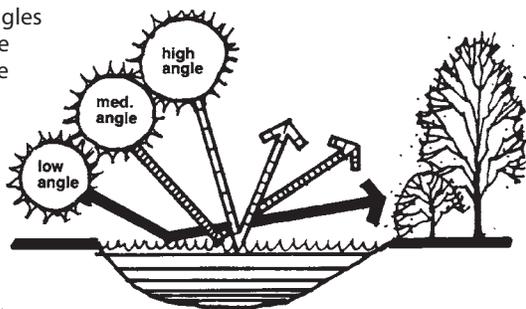


Figure 26. Placement of plants between glare source and viewer.

Figure 27. Angles of glare source and respective angles of reflection.



Climate Control with Plants

People plant and design landscapes for human use—sitting, eating, playing sports, reading, and siting the house. The use of such areas throughout the year is often limited by climatic factors including hot sun and cold, forceful winds. Landscape plants can be used as air conditioners, heaters, and humidifiers to alter the climate around us for maximum human comfort.

The climate of the immediate area around us is called microclimate. To a great degree, it is determined by macroclimate or the climate of the greater region involving average, maximum, and minimum temperatures; prevailing winds; and annual precipitation. The microclimate is further influenced by surrounding air temperature, solar radiation, air movement, humidity, sun orientation, topographical location, and proximity to large tree stands, major water bodies, and large, dense urban areas containing great amounts of concrete, asphalt, and glass. For example, a house set on a prominent ridge will experience stronger winds than a house set within a depression or valley. Similarly, a house located in a central city area will experience higher temperatures than one located on a wooded lot in a rural or suburban area.

The designer should consider plant groupings for climate control an integral part of the overall aesthetic landscape treatment. In order to best determine how to use plants for comfort control, it is advisable for the designer to first analyze microclimate factors. This will require consideration of climate conditions during all four seasons of the year.

A visual survey of the surrounding topography will help detect wind movement. Note any major ridge lines, valleys, and low depressional areas. Also consider any major water bodies that will act to modulate temperatures and influence air movement. The local weather bureau can provide information regarding the direction of the prevailing winter and summer winds and average seasonal temperatures.

The most important factor influencing the climate is solar radiation. Controlling solar radiation with trees, shrubs, ground covers, and lawn is one of the most important functions of plants in many tropical and arid parts of the world. Plants can be used to reflect, obstruct, and filter

solar radiation before or after the sun's rays strike the surface. Obstruction is most effective with a canopy of dense foliage in multiple layers using trees such as maples, oaks, and beeches. Filtration of the sun is somewhat less effective using less dense trees such as willow oak or honeylocust. How much temperatures are reduced depends on which tree species is used. It has been shown that a stand of beech trees in July will reduce air temperature fluctuation at ground level of 8 degrees Fahrenheit, a stand of fir about 7.2 degrees Fahrenheit, and a stand of Scotch pine about 5.4 degrees Fahrenheit (5).

Shrubs, ground covers, vines, and lawns also moderate air temperatures near the ground and against buildings. Temperatures over lawn areas on a sunny summer day can be 10 to 14 degrees Fahrenheit cooler than exposed soil (6). This difference is even more pronounced with exposed, dark pavements such as asphalt. Many of us have experienced such effects while walking barefoot across an asphalt parking lot or street on a sunny summer afternoon. Later in the evening, such paved areas readily re-radiate absorbed heat into the warm evening air. Plants absorb the sun's rays but do not re-radiate the heat into the air. The increased humidity caused by the evapo-transpiration process of plants contributes further to this moderating effect.

To most effectively discourage strong winter winds, plant groupings must be placed perpendicular to oncoming winds to act as a barrier. Temperatures on the leeward side of a windbreak can be up to 5 degrees Fahrenheit warmer than the windward side (7). The width of the windbreak does not affect the wind velocity as much as the density of the windbreak. This is especially fortunate for homeowners since the size of most residential lots will not allow for wide, thick plantings. In general, wind velocity is reduced for a distance two to five times the height of a wind barrier on the windward side and 10 to 15 times the height on the leeward side (Figure 28).

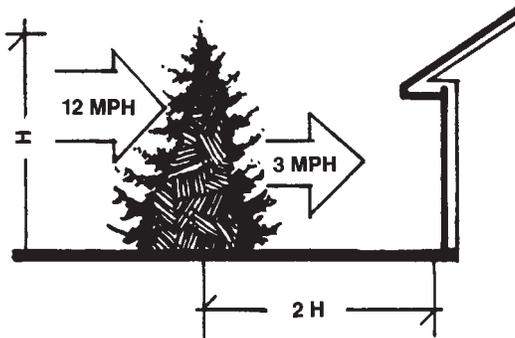


Figure 28. Use of windbreaks to control winter winds.

Dense evergreens are effective plantings for controlling temperatures in winter months. However, many evergreens such as pine will lose their lower branches with age, necessitating additional shrub plantings below. Also, taller deciduous tree stands tend to be more open in the canopy and at the trunk bottom where air movement actually speeds up through the trunks. Thus, more rows of trees with varying heights and canopies are required for effective protection.

Plants can also be used in the same manner as insulation in a house. The placement of evergreen massings (arborvitae, spruce species) densely planted near the house will create dead air between the two. This dead air helps to prevent loss of heat from the house. With a constant house temperature of 70 degrees Fahrenheit, fuel savings can reach 23 percent (8).

Wind is not always a negative factor in the landscape. Air movement increases body cooling and can be used to ventilate and cool an area during hot summer days and nights. Studies show plants to be effective in directing wind movement through and about buildings (9). It has also been determined that air movement speeds up as it passes underneath a tree canopy. Thus, it can be used to cool a building or an outdoor living area (Figure 29).

In most areas of the country, the prevailing winter and summer winds are from different directions, the northwest and the southeast, respectively. Both winds can be controlled with plants—evergreens along the northwest and deciduous along the south—without interfering with each other. However, in certain parts of the country, such as central Kentucky, both prevailing winter and summer winds are from the south-southwest. In these areas, it is difficult to control both winds since the placement of evergreens for winter winds will block summer breezes. The designer should consult the local weather bureau for accurate information on prevailing wind directions.

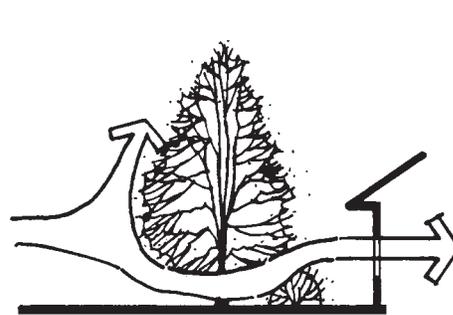


Figure 29. Use of deciduous plants to direct summer breezes.

The Aesthetics of Plants

*To him in the love of nature holds
Communion with her visible forms,
She speaks a various language...*

—William Cullen Bryant, *Thanatopsis*

The endearing beauty of landscape plants has been the subject of painters, sculptors, poets, philosophers, and scientists throughout the ages. People of all races, religions, and nationalities devote countless hours and resources to the care of landscape plants. It is no small wonder, for plants appeal not only to our intellects but also to our physical senses and emotions.

The most obvious aesthetic appreciation of plants is through the physical senses of sight, smell, sound, and touch. Individual parts of plants—blooms, fruits, leaves, and branches—are valued for their color, shape, aroma, and texture.

Plants can also be appreciated for the sculptural quality of overall size, color, and form. Unusual or prominent plants can be used as focal points to contrast their surroundings. They also can be used as a backdrop or setting for focal points. Just as with the display of art in a gallery, much thought should be given to the display of plants. Whether you want the focal point to be viewed from one or several vantage points, the subject must appear dominant within its context but never overpowering. The plant should appear contained within the setting but never engulfed by it. Keep the setting simple and continuous, yet harmonious and complementary.

A massing of one or two species of noticeably shorter- or taller-growing plants can be used to either back drop, frame, or pedestal the focal point and is an appropriate planting scheme (Figure 30).

The composition of views to particular focal points or open vistas can also be done with plants, keeping in mind the general rules of composition within painting. A typical romantic English landscape painting utilizes a foreground, middleground, and background to present its subject (Figure 31).

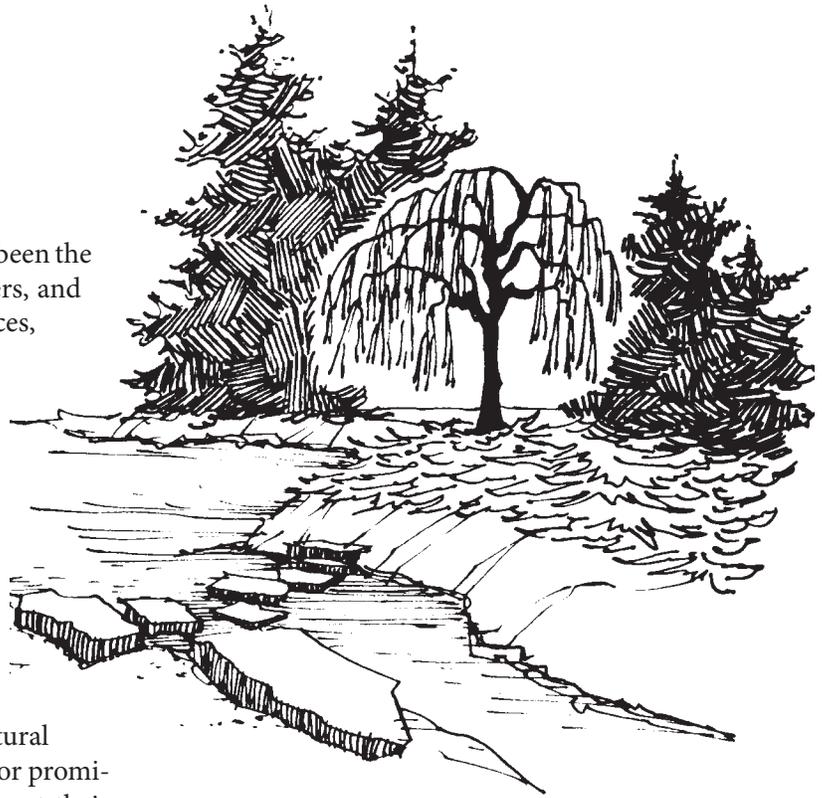


Figure 30. A specimen plant is set off as a focal point.

The main subject is set within the middleground. The foreground and background provide the setting, give context and scale, and emphasize the main subject. Contrast of sunlight and shade between all three can be used to emphasize the subject even more effectively.

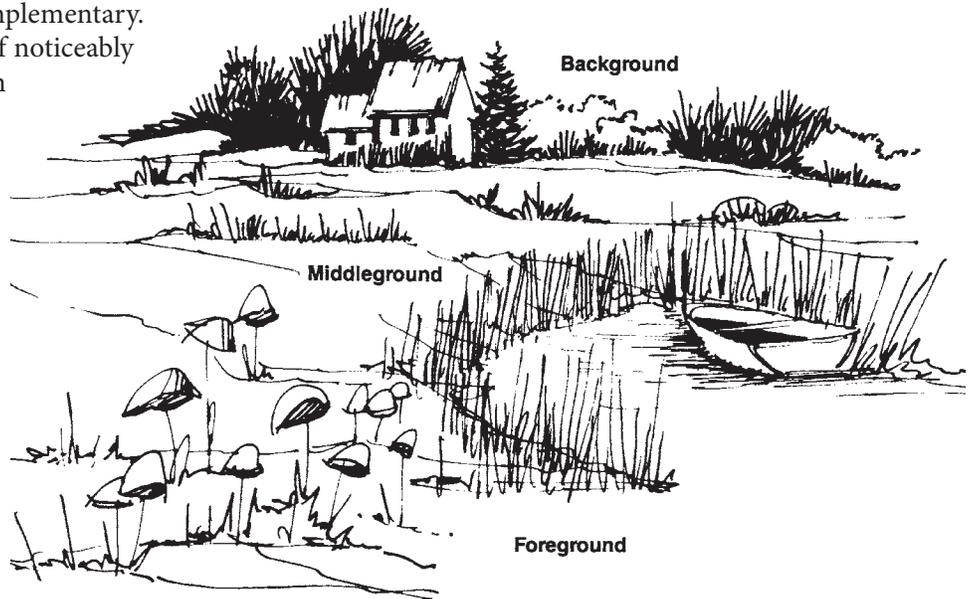


Figure 31. A typical landscape composition with foreground, middleground, and background.

The overall form and size of a plant also gives birth to its personality and creates a certain intangible atmosphere around it. How this personality affects our moods and emotions constitutes what is perhaps the less obvious aesthetic trait of plants. Often a plant can be described as if it were a person—humorous, gay, witty, sad, pensive, nervous, sophisticated, or shy.

When a particular human activity is set within this atmosphere, a certain magical quality is created that instills a long-lasting impression in the minds of participants. Such was the ambiance of the formal French gardens in the 17th century. Geometrically clipped evergreens, scriptlike parterres, and long canals bordered by allees of horse chestnut trees were combined with the pageantry of a royal promenade by King Louis XIV and court to create the extravagance, gaiety, splendor, and power of Versailles (Figure 32).

A large, stately, mature beech tree in an English garden imparts a certain air of permanence and security to a late afternoon tea party. An intricately branched, lacy-leafed Japanese maple with a gnarled trunk bordered by a mound of azaleas carefully clipped to conform to the hillside reinforces the meditative, individualistic, and respectful qualities of a Buddhist ceremony. The large weeping forms of cherry trees bordering the drives in Lexington Cemetery impart a certain feeling of sadness and reflection of a slow funeral procession. A tall grove of mature hemlocks creates a perfectly dark and cool setting for the mystery and suspense of a children's game of hide-and-seek.

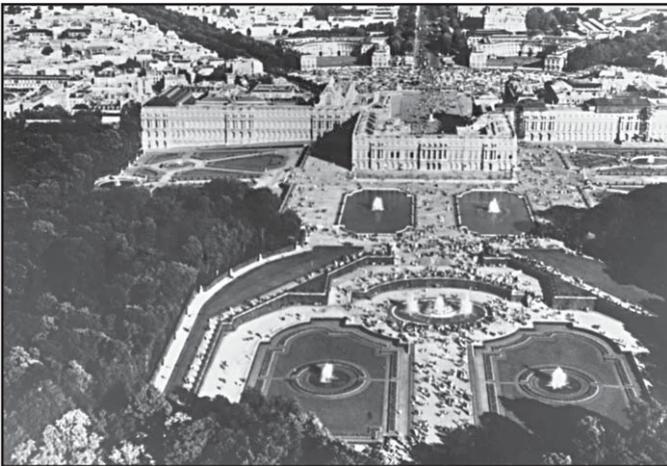


Figure 32. A garden, a canal, and a carriageway create the splendor of Versailles.

Landscape plants can also act as symbols of human accomplishments, beliefs, cooperation, defeats, and victories. Commemorative tree plantings have traditionally been set at the spot of a decisive Civil War battle or in a college quadrangle. Careful cultivation of shrubs and flowers by an elderly or disabled person symbolizes a strong personal interest in life, growth, and prosperity.

Trees have been planted by war veterans as symbols of long-lasting peace. They have been planted by parents on their baby's first birthday to share in his or her growth toward adulthood. Organized neighborhood tree plantings are evidence of the cooperative efforts and sense of purpose of a group of people.

Landscape plants of all sizes and types serve as constant symbols of the enduring human need for contact with the natural environment.

References

1. Carpenter, P., Walker, T., and Lamphear, E. *Plants in the Landscape*. Freeman & Co., San Francisco, 1975, p. 172.
2. Aloys, B. "Climatic Influence of Greens and City Planting," *Anthos*, (No. 1. 1966), p. 23.
3. Robinette, G. *Plants, People and Environmental Quality*. (U.S. Dept. of Interior, 1972), p. 41.
4. Embleton, T. F. W. "Sound Propagation in Homogenous, Deciduous and Evergreen Woods," *Journal of the Acoustical Society of America*, 1963, p. 112.
5. Robinette, p. 70.
6. Meterich, A. *Bericht uber die Untersuchung der Einwirkung des Waldes auf die Menge der Niederschlage*. Neudamn, 1903, p. 32.
7. Robinette, p. 96.
8. Robinette, p. 77.
9. White, B. F. "Effects on Landscape Development on the Natural Ventilation of Buildings and Their Adjacent Areas." *Texas Engineering Experiment Station, Research Report 45*. Austin and College Station, Texas, 1945, p. 24.

*Photographed by Betsy Thompson
Illustrated by Jan Cervelli*